INCREASED USE OF ENVIRONMENTALLY PREFERABLE, NON-TOXIC PRODUCTS TO REDUCE COSTS, LIABILITIES, AND POLLUTION AT DOT OFFICES, MAINTENANCE AND OPERATIONS FACILITIES, AND REST STOPS

Requested by:

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and Transportation Officials (AASHTO)

Standing Committee on the Environment

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Acronyms

AASHTO	American Association of State Highway and Transportation Officials
CFC	Chlorofluorocarbons
DOT	Department of Transportation
EDF	Environmental Defense Fund
EMS	Environmental Management System
EPP	Environmentally Preferable Products/Procurement
HMIS	Hazardous Materials Identification System
HVLP	High Volume Low Pressure
LCIA	Life Cycle Impact Assessment
MSDS	Material Safety Data Sheet
PVC	Polyvinyl Chloride
RFP	Request for Proposal
SPCC	Spill Prevention Control Countermeasure
TCE	Trichloroethylene
TRACI	Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

1 Introduction

Governments at all levels in the U.S. spend over $700 billion on procurement annually, comprising $1 of every $5 spent in the U.S. As large buyers with environmental stewardship responsibilities and commitments, Departments of Transportation (DOTs) can play a role in shifting the U.S. toward sustainability and away from materials known to cause human health or environmental problems, through the purchase and use of environmentally preferable products and services. Environmentally preferable means "products or services that have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose," according to the *Instructions for Implementing Executive Order 13423 Strengthening Federal Environmental, Energy, and Transportation Management (March, 2007)*.

Preference for "green" materials can be facilitated in many ways across the product life cycle (raw materials, manufacturing, distribution and storage, product use, and product disposal and recovery) and have many benefits. Historically, green products were considered hard to find or had inferior performance or prohibitive costs. Today, a wide variety of green products is available for use across DOT operations and maintenance sites, and can perform as well as higher toxicity products, and can cost the same or less. The obstacles to greater use of cost-effective green materials need to be discovered and unintentional obstacles strategically overcome, from lack of information to defined purchase agreements/standards based on specified products.

To date, thousands of U.S. products and services have been certified[1] as "green" or less toxic and a number of government entities have been working on "greening government." However, no evaluation has occurred with regard to which of these green products may be used in the maintenance of transportation facilities.

1.1 Research Objectives

The objective of this study, *NCHRP 25-25/60, Increased Use of Environmentally Preferable, Non-Toxic Products to Reduce Costs, Liabilities, and Pollution at DOT Offices, Maintenance and Operations Facilities and Rest Stops*, was to identify "green" or less toxic products that could be used by DOTs in the operation and maintenance of their facilities. It is anticipated that such substitutions will be able to help DOTs reduce:

1) Compliance permitting, reporting, and inventory requirements;
2) Liabilities, medical monitoring, and other worker health and safety concerns;

[1] Product certification includes an audit or inspection carried out by a party other than the supplier (first party) or the sourcing company (second party) without any financial interest or stake in the sales of the product or service being certified or other conflict of interest. A standard must form the basis of the certification, be appropriate and meaningful for its intended purpose, and be publically available and developed with stakeholder input. Certification to the standard must be completed by an independent party (i.e. not the product company), and include site inspections, where applicable, and have a monitoring program to verify ongoing compliance.

3) Environmental impacts and the related problems of hazardous material storage, use, and disposal; and

4) Costs for regulatory fees, disposal and recycling fees, and costs for environmental compliance and worker protection.

The goal was to develop a manual of product specifications for products most commonly used by state DOTs, explain the benefits of green products, and provide guidance on how to implement and monitor green purchasing programs. In addition, to assist state DOTs in their efforts to implement green purchasing programs, this manual may also serve as a springboard from which DOTs may decide to conduct a thorough analysis of the products they currently purchase and to develop action plans to increase green purchasing over time.

1.2 Methodology

The research approach included five main tasks.

In Task 1 we conducted a brief survey of all state DOTs to do a preliminary assessment of the toxic/hazardous products purchased, stored, and used at highway maintenance and operations facilities and highway rest areas. We then identified specific products within each of these broad categories. We provided the categorized inventory in a spreadsheet format for the NCHRP panel's review and identified toxic/hazardous "chemicals of concern" in these categories.

In Task 2 we identified and interviewed appropriate state DOT and purchasing agency personnel to collect information on how DOTs purchase maintenance products and identify obstacles and barriers to greater use of cost-effective green materials.

In Task 3 we ranked product categories by chemical components and environmental impact using multiple well-regarded databases.

In Task 4 we produced the green purchasing manual that accompanies this report. The manual includes specifications for 19 products identified in the DOT interviews or by the NCHRP Panel members and how to apply the specifications.

In Task 5 we developed this report which summarizes our research approach and key findings for all of the above four tasks, and includes guidance on developing a green purchasing program.

2 Survey and Interview Findings

The survey and interviews together revealed some of the most common challenges for DOT maintenance personnel in the identification and use of green maintenance products.

2.1 Identification of Products Used in the Maintenance of DOT Facilities

The first step was to compile an inventory of the toxic/hazardous products that are currently purchased, stored, and used at highway maintenance and operations facilities, and highway rest areas. DOT Maintenance Managers from all 50 states, Washington, D.C., and Puerto Rico were asked to provide purchasing data, including contracts and/or RFPs that could provide information on the DOTs' current purchasing specifications, product performance requirements, annual spending, frequency of use, and annual volume. Sixteen DOTs responded to the initial request for information.

This research yielded a number of important findings. Although DOTs shared, and the team reviewed, voluminous information, DOTs were nevertheless frequently unable to identify specific products currently in use, much less their quantities. With many purchasing methods in play, including small purchases at local hardware or automotive stores, it was very hard for DOTs to provide the study team with comprehensive data of any sort on the amount of products purchased. While more information was typically available on herbicides, the use of this material is among the most highly variable in each state, due to different environments and invasive species control needs. Of greatest interest was information on other hazardous/toxic chemical products DOTs use, but few DOTs were able to provide the requested information in this area.

Early discussions with the DOTs also revealed that:

- Several DOTs have already begun to use green products or have effectively increased usage of green products in a variety of ways.
- Oregon and Massachusetts DOTs have environmental management systems for managing materials in their maintenance yards or depots, which has effectively reduced use of toxic alternatives and increased use of green products.
- Other DOTs, such as Minnesota, publish annual pollution prevention reports detailing product changes.
- Environmentally preferable purchasing mandates from upper management do not always filter down to the maintenance staff. The absence of centralized systems or procedures and the historic flexibility and autonomy of maintenance forces means that they are often not able to provide specific information about products used.
- Many DOTs use private contractors for maintenance of rest areas, the application of herbicides, and bridge maintenance and, therefore, they don't keep related products on-site or necessarily know what specific products are used.

- Many DOTs purchase herbicides through a central purchasing office and thus have better records in this area; however, most other products are purchased at the district or regional level through normal purchasing procedures, meaning there may not be a formal tracking process. In such cases, DOTs lack good methods to track specific items for cost and amount of use. The interviews revealed that some DOT purchasers do not use competitive bidding, but instead purchase products at local stores or from a particular supplier. One DOT reported that they had specifications for herbicides "but not cleaners or solvents." Furthermore, "much of the product selection depends on which companies reach out to a facility and personal preference for one product versus another."

Reflecting these findings and challenges, the study team recommended to the NCHRP Panel that the prioritization study in Task 3 put greater weight on the environmental impact and environmental improvement potential of broad product categories, as the necessary information about specific products used and the volume of these products purchased was generally lacking. The research team concluded that a prioritization focused on these parameters would be useful to all state DOT purchasers because it allows each purchaser to factor in their own DOT's spending volume. Even in the absence of readily accessible spending volume data, environmental impacts and improvement potential provide a sound basis for prioritizing chemicals of concern for purposes of finding and purchasing greener alternatives.

2.2 DOT Interviews

The study team interviewed multidisciplinary DOT personnel in seven states that represent a broad geographical spectrum from across the country to get an understanding of how hazardous or toxic maintenance products are purchased and to identify obstacles or barriers to the use of green products. More than a dozen other DOT personnel involved in the purchase and use of maintenance products in seven additional states also provided valuable information.

Representatives from the following states participated in the interviews:

- Alabama
- Kansas
- Massachusetts
- Minnesota
- New York
- North Carolina
- Washington State

The technical experts interviewed as part of this research represented a cross section of personnel involved in the purchase and/or use of hazardous or toxic materials and included an:

- Environmental Engineer
- Safety Coordinator
- Hazardous Materials Coordinator
- Purchasing Analyst

- Director, Equipment Unit
- Assistant Manager, Fleet Administration & Support
- Facility Environmental Engineer
- Environmental Coordinator
- Clean Water Program Technician, Office of Operations and Maintenance

The interview included 14 open-ended questions focused on the following topics:

- Purchasing procedures
- Identification of maintenance products
- Green products currently in use
- Benefits of using green products
- Obstacles/barriers to purchasing green products

One of the more significant findings is that there is no central database to track product purchasing, the amount of product inventory, or the frequency of product use, and locally purchased products may not be tracked even at the district level. In addition, for services that are provided by outside contractors, e.g., weed control or maintenance of rest stops, information about quantities used was unavailable unless requested directly from the vendor. Improved tracking systems are among the most important areas for DOT action and improvement.

Of most importance to this study was the identification of products used and the perceived barriers or obstacles to the purchase and use of green products. The following sections present the interview results.

2.2.1 Purchasing Procedures

Nearly all DOTs interviewed said individual purchasers determine the purchase of hazardous or toxic materials. Although the central office generally determines the budget, and any blanket contracts usually come from the central office or the state, each District Manager typically determines the products to purchase. Since purchasing is done at the district level, some districts may purchase different products than others within the same agency and there can be a great deal of variability of products purchased based on rural versus urban environments, climate differences between the districts, proximity of maintenance activities to environmentally sensitive areas, and personal preferences.

Commonly, DOTs purchase products through a competitive bid process, according to the personnel interviewed. Green specifications, if any, are included in the Request for Proposals (RFP). Another common method for purchasing maintenance products is through sole source contracts with industrial supply stores such as Grainger, Waxey, or Coast Wide Laboratories. Finally, staff often make small purchases at local home or auto supply stores. In at least one state, each region has the flexibility to purchase products via a contract or to buy locally to get the best price.

One of the more significant findings is that none of the DOTs interviewed have a central database to track product purchasing, the amount of product inventory, or the frequency of

product use, and locally purchased products may not be tracked even at the district level. In addition, for services that are provided by outside contractors, e.g., weed control or maintenance of rest stops, information about quantities used was unavailable unless requested directly from the vendor. One state informed the research team that information for janitorial products was not available because the supplier has no mechanism to capture the information.

A few DOTs provided long lists of products they can use, including some green maintenance products, but because few states have centralized data systems about product purchased, we were unable to put together an inventory of existing products and level of use.

2.2.2 Obstacles/Barriers to Purchasing Green Products

Many DOTs are actively seeking opportunities for greening maintenance activities. Increasingly, DOTs are focusing on reducing the quantities of hazardous or toxic materials used and increasing recycling opportunities. MNDOT has posted on its website a commitment to lowering costs and liability and protecting the environment through increased use of green products. However, most states do not have formal policies related to the use of green products.

DOT responses to the interview questions were notably consistent across disciplines involved in the purchase and use of maintenance products, as well as throughout agencies across the country. Interviewees described the following obstacles or barriers to the purchase and use of green maintenance products.

Purchase price versus life cycle cost

- DOTs are typically required to purchase products with the lowest cost, and most believe that green products are somewhat more expensive. DOTs can purchase more expensive products, but they must justify the additional expense.
- Purchasing requirements come from the state legislature and the use of more expensive or alternative products may require legislative approval.
- The DOT must purchase directly from protected vendors such as correctional facilities. The DOT can try to provide specifications, but products will be limited to the institute's capabilities.
- Maintenance and contracting personnel need training to understand the benefits and performance of green products.

Performance

- Generally, respondents felt that citrus based, non-petroleum based products do not clean as well as degreasers/solvents such as mineral spirits, trichloroethylene (TCE), and naphtha.
- Bridge maintenance materials are the most difficult products to replace with greener products – yet "they are the worst of the hazardous solvents". For example, for sealant guns the manufacturer recommends using xylene because it is the only solvent that is effective on that type of sealant; specialized performance requirements continue to be a problem.

- Some green products are less effective – "It's not efficient or cost effective if it takes twice as much product to do the job."

Identification of green versus non-green products

- The DOT needs someone who can act as a champion for sustainability and be able to dedicate the time necessary to research products and communicate the needs and opportunities to management.
- Users are not aware of which products are green and which are not.
- State DOTs typically do not have the resources for someone to review the products they purchase and identify alternatives.

Policy/Management

- The state legislature may have some generic mandates, e.g., reduce paper usage or fuel switching, but most state DOTs do not have any policies that require the use of the least toxic products available.
- It would be more effective to have the purchase of such products done in a more centralized manner, at least at the regional level, to support greater use of green products.
- The environmental staff can make recommendations for greener products, but absent any written policy, personnel that write the contracts and purchase the products do not have enough experience to select green products.
- Some DOTs have management support for green purchasing, but such leadership is lost or diffused because of the DOT's decentralized structure and customs regarding independent decision -making on a district level.
- A number of DOTs said that bureaucracy, apathy, and resistance to change have resulted in less emphasis on green purchasing. In the absence of clear requirements to use greener products, end-users often prefer to use the same conventional products they have always used in the past.
- In a large state with thousands of employees, it is difficult to keep everyone informed on available green products or monitor their use. Better methods for disseminating the information and management support are needed to increase the use of greener products.

3 Identification of Toxic Products and Alternatives

This section describes how we identified products for evaluation and developed the Environmentally Preferable Purchasing Guide.

3.1 Rankings by Use and Environmental Impact

Typically, the first step in developing a green purchasing program is to conduct a comprehensive analysis of all products purchased, to assess the dollar volume of each purchase annually, as well as the relative toxicity, and the expiration of all existing contracts. Once this product purchasing list is developed, the agency can then develop a plan for which specifications to "green" are based on three factors: volume, toxicity, and contract end date. The DOTs participating in this study did not typically collect or maintain much of this information beyond Material Safety Data Sheets (MSDS). MSDS are widely used to provide information on the chemicals present in a product or material and often include information about their potential hazards and instructions for their use.

What they did have beyond these basic regulatory requirements tended to have numerous gaps that undercut the quality of the data and would have been cost prohibitive to reconcile across the DOTs. To focus on what would be most useful to DOTs given the data available, we identified eight broad product categories for investigation, based on the state DOT interviews:

- Pesticides
- Agricultural chemical products
- Vehicle and equipment maintenance
- Facility operation and maintenance
- Cleaning products
- Road maintenance
- Laboratory materials
- Other

For each of these eight broad categories the study team identified the sub-products that typically fall within each category. In total, we identified 60 sub-products (see Table 1). Two product categories – facility operation and maintenance and vehicle and equipment maintenance – accounted for approximately 35 of the 60 sub-products. In creating the list of 60 sub-products, there was a lot of overlap in terms of the specific products. For example, the sub-products might include polyvinyl chloride (PVC) pipe adhesive or industrial cleaners for multiple purposes.

The NCHRP advisory panel designated four product categories as being of "high priority" and asked that green bidding specifications be developed for these four product categories. These four product categories are:

- Herbicides
- Disinfectants with high bacterial kill-rate

- Garage greasers, lubricants and solvents to clean parts
- Materials used in bridge maintenance (chemicals and solvents used for cleaning and preparation of bridge for painting).

Table 1: Sub-Product Categories

Pesticides: Herbicides Insecticides Rodenticides Fungicides **Agricultural Chemical Products:** Fertilizers **Vehicle & Equipment Maintenance:** Vehicle parts cleaners Brake & carburetor cleaner Solvents Gas/diesel mixtures Grease products Oils – engine/lubricating/penetrating Oil filters Oil sorbents Transmission fluids and oils Antifreeze Solvent based paints Asbestos in brakes Di-isocyanate paints Paint thinners Rust-inhibiting primers Hydraulic fluid Windshield washer fluid Power steering fluid Chain lubricants Tire balancing weights Automotive – Fuels Heating oil Fuel additives for diesel, gasoline Batteries for vehicles Starting fluid Coolants/Freon/Refrigerant Spray-on truck bed liners Cutting oils	**Facility Operation & Maintenance:** Heating oils Paint thinners Solvents **Cleaning Products:** Cleaning Supplies **Road Maintenance:** Asphalt Pothole repair Traffic line and marking paints Road striping Road flares Absorbents De-icers Ice/salt control or chemicals on roads **Laboratory Materials:** Paint related material (residues from testing of zinc rich primer, and vinyl finish coat) Muratic acid Acids and bases Calcium carbide for soil testing **Other:** Heavy metals Electronics Adhesives Chlorofluorocarbon (CFC) Blasting compounds Wood preservative Fuels Education lighting Energy efficient products Green buildings Petroleum storage tanks

The panel was also interested in specifications being developed for the following two products:

- Paints used to paint and repaint plows
- Dispersive uses of diisocyanate based paints

We were able to include green product specifications for all of these products, with the exception of bridge maintenance materials. No less toxic alternatives were found for bridge maintenance materials, so they are not included in the green purchasing manual.

We collected product information[2] provided by the manufacturer in the product's MSDS and used the MSDS overall health rating for each product to identify the most hazardous products. We also collected information from a pollution information website called Scorecard (initially developed by the Environmental Defense Fund) to determine which of the chemical constituents listed in the MSDS is the most hazardous.[3] By the end of this process, 40 chemicals of concern were identified from the chemical composition of the 60 sub-products. We then analyzed each of these chemicals using SimaPro for environmental impacts over their life cycle, called life cycle impact assessment (LCIA) from "cradle-to-gate." This approach examines environmental burdens associated with their manufacturing process, production of raw materials utilized, and production and distribution of electricity and fuels. We used the TRACI (Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts)[4] methodology developed by the U.S. Environmental Protection Agency (U.S. EPA) to conduct the impact assessment.

3.1.1 Selection of Representative Products

For each of the eight broad product categories and the 60 sub-product categories identified from the state DOT interviews, we used information available from the Household Product Database maintained by the U.S. Department of Health and Human Services to identify a total of 95 sample products that should be evaluated. [5] The Household Product Database also includes product information from each product's Material Safety Data Sheet (MSDS), which provides information on physical and chemical properties of the product, instructions for safe use and potential hazards associated with the product. The MSDS also has an overall health rating for each product. For each of the 95 sample products, the health rating in the MSDS was used to develop the first cut of a prioritized list of product categories.

3.1.2 Assessment of Chemical Constituents

For each of the 95 sample products, we used information from Scorecard to compile hazard rankings of each individual chemical ingredient in the product[6]. For each particular product, the chemical constituent with the highest number of hazard rankings was selected to be

[2] Green Seal used information available from Household Product Safety Database (https://householdproducts.nlm.nih.gov/)
[3] http://www.scorecard.org.
[4] http://www.epa.gov/nrmrl/std/sab/traci/.
[5] https://householdproducts.nlm.nih.gov/
[6] http://www.scorecard.org.

analyzed for its life cycle impacts. By the end of this process, 40 chemicals of concern were identified from the chemical composition of 95 sample products.

3.1.3 Life Cycle Impact Assessment

Each of the 40 chemicals identified (see Table 2) was then analyzed for environmental impacts over their life cycle, called life cycle impact assessment (LCIA) from "cradle-to-gate." LCIA is used to estimate the environmental impacts from resource extraction to the chemical leaving the gate of the production facility were included. This approach examines environmental burdens associated with their manufacturing process, production of raw materials utilized and production and distribution of electricity and fuels. The following eight life cycle impact categories were analyzed for each chemical where data was available:

- Global warming
- Acidification
- Carcinogens,
- Respiratory effects
- Eutrophication
- Ozone depletion
- Ecotoxicity
- Smog

Table 2: Forty Chemicals of Concern

• 1,2,4-Trimethylbenzene	• Methyl ethyl ketone
• 2-(2-Methoxyethoxy)ethanol	• Methyl isobutyl ketone
• 2-Butoxyethanol	• Monoethanolamine (MEA)
• Butane	• Naphthalene
• Chlorodifluoromethane	• Oxalic acid
• Copper naphthenate	• Polyvinyl chloride (PVC)
• Copper sulfate	• Potassium hydroxide
• Cyclohexane	• Propane
• Dibutyl phthalate	• Sodium carbonate
• Dichlorofluoroethane	• Sodium metasilicate
• Dichloromethane	• Solvent naphtha, petroleum, medium aliphatic
• Diethylene glycol ethyl ether	• Stoddard solvent

• Diethylene glycol monobutyl ether	• Sulfuric acid
• Diisocyanate	• Tetrachloroethylene
• ethane 1,1-oxybis	• Tetrahydrofuran
• Ethylbenzene	• Tetrasodium EDTA
• Formic acid	• Toluene
• Isopropanol	• Trichloroethylene
• Lead	• Xylene (mixed isomers)
• Methanol	• Zinc phosphide

As an example, the life cycle impact assessment results for one chemical constituent, **ethylenediaminetetraacetic acid,** are provided in Table 3.

Table 3: Life Cycle Impact Assessment Results for Ethylenediaminetectraacetic Acid

Impact category	**Unit**	**ethylenediaminetetraacetic acid**
Global Warming	kg CO_2 eq	4.49E+00
Acidification	H^+ moles eq	6.55E-01
Carcinogenics	kg benzene eq	7.84E-03
Respiratory effects	kg PM2.5 eq	3.18E-03
Eutrophication	kg N eq	1.10E-02
Ozone depletion	kg CFC-11 eq	5.54E-07
Ecotoxicity	kg 2,4-D eq	3.97E+00
Smog	kg NO_x eq	7.33E-03

The TRACI (Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts)[7] methodology developed by the US EPA was used to conduct the impact assessment.

[7] http://www.epa.gov/nrmrl/std/sab/traci/

For 10 of the 40 chemicals, suitable proxies were available. For six of the 40 chemicals the desired information was not available, nor was there a suitable proxy. Thus, after this step we had a list of 30 unique chemicals for our 95 products.

We then identified which of the 95 sample products had these 30 chemicals of concern.

3.1.4 Selection of Priority Products for Green Specifications

The life cycle impact assessment results for each impact category were normalized with the respect to the chemical having the highest impact in that particular category. The chemical with the highest impact in each category was assigned a normalized score of 100 and all other chemicals were normalized relative to this score. Subsequently, the average normalized score from eight impact categories for each chemical was evaluated. A chemical with an average normalized score of 10 or higher was selected to be on the priority list. Using this approach, we identified 23 sub-product categories, in addition to the four products requested by the NCHRP panel not already in the list, bringing the total number of product categories on our list to 27. The final number of specifications in the manual totals 19, as for some of the 27 products we were unable to confirm that environmentally preferable products are, in fact, available for purchase.

3.2 Identification of Equally Effective, Non-Toxic or Low-Toxic Alternatives

During this task, selected product categories were reviewed and material environmental impacts identified. In some cases, the identified material impacts for the respective product category concerned materials' use or recycled content, and thus fell outside the mandate of this project (reduction of toxic or hazardous constituents). For example, state DOTs mentioned their use of asphalt, road-building materials, and office supplies as items purchased frequently. However, the green alternatives to these products would not result in reduced toxics, but instead would focus on increased recycled content, a topic that is covered in NCHRP 25-25/04, AASHTO's Compendium of Environmental Stewardship Practices in Construction and Maintenance.

In other instances, selected product categories did have material toxicity concerns, but suitable alternatives were not readily available. For example, we could not identify an environmentally preferable alternative for bridge-building materials. After further consultation with DOT staff, the research team determined that the primary concern was the chemicals and solvents in the joint sealants used in bridge maintenance; however, we could not find alternatives that would be suitable to use as substitutes to existing products.

In addition, fuel was identified as a major purchase category for state DOTs. This product category was also eliminated from the list of priority products for the purchasing manual because the major environmental concern revolves around the use of bio-fuel blends. The use of these blends will depend on specific state requirements and further research will be necessary to assess the full environmental impacts associated with the use of this fuel.

The Green Purchasing Manual that accompanies this report includes 19 product specifications, as well as supporting material that includes the following:

- Introduction to Environmentally Preferable Procurement (EPP) for state DOT agencies
- Structure and use of individual product standards/specifications
- Exemption clauses for state DOT agencies for use in an EPP program
- Metrics and data collection to track the success of the program

The purchasing manual includes green specifications for the following products:

- Anticoagulant rodenticides
- Brake cleaner
- Building paint (Interior, Exterior)
- Carpet
- Cleaners/degreasers with trichloroethylene
- Computers
- Diisocyanate automotive paints
- Electronics cleaner
- Engine coolant/Anti-freeze
- Herbicides
- Janitorial cleaning supplies
- Paint primer
- Paint strippers and thinners
- PVC pipe cement
- Road marking paint
- Silicone lubricants
- Snow and ice control chemicals
- Treated lumber
- Windshield washing fluid

Each product specification includes the following sections:

A. Technical specification to be inserted directly into the bidding document. The specification section includes specific characteristics that the product should meet, and is focused on eliminating products with certain chemical components altogether and

reducing toxic chemicals in the product. For example, the specification for herbicides requires that only herbicides categorized as class 1 or class 2 be purchased, in lieu of the more toxic category 3 and 4 herbicides. The specifications do not include specific products by name. Where products have been evaluated by neutral third parties, we have provided a link as a reference in the background information of the respective product specification. In addition, each specification has been developed to allow purchasing agencies flexibility in selecting the product that is the best fit for the agencies' needs.

B. Application – a section that is for internal use by the DOT only, that details the product types and also the quantity of the product(s) to which the new green specification should apply.

C. Environmental Impacts – a section also for internal DOT use that provides a summary of the specific environmental or toxicity issue of concern (for example, volatile organic compounds), the objective of the new bidding specification (for example, obtain products with low VOC content), and comments, which explain in more detail the specification requirement. Many of the products contain more than one issue in the environmental summary. This section notes the environmental benefit of the alternative product.

D. Rationale and Background – also for internal DOT use, this section provides background information on the chemical or property of concern, as well as the URLs of websites with either the details the specification is based on, and/or additional background information. In many cases, there are links to websites that contain information on products that have been certified to meet the technical specifications under section A, above.

E. Cost Impacts – includes a brief description of the cost impacts, where known.

F. Purchasing Metrics – includes information the state agency should collect to be able to monitor the percentage of products purchased that comply with the new green specifications.

The product specifications do not provide examples of specific alternative products. This is because providing specific product alternatives – as opposed to providing specifications as we do here – is fraught with controversy. There is no comprehensive list of "green" alternative products, and specifying some would inevitably leave out new entrants to the field. While we might be able to include examples of a green alternative product, we do not believe it is appropriate to endorse specific products, absent a more comprehensive, rigorous evaluation. Instead, as noted in the manual, where neutral third-party organizations have developed lists of environmentally preferable products that meet the specifications, a link to those lists and certified products is included in the "background" section of the product specification.

Similarly, the product specifications do not provide information on the effectiveness and performance of specific products that would meet the alternative product specifications included in the manual, since research into more specific alternative products was beyond the

scope of this project. In past efforts, where we have worked specifically with a single purchasing agency, and where we have been able to invest a greater level of effort on each product specification, we have been able to achieve this by sitting down with the user of the product and identifying the key performance metrics. In the green product manual, however, we suggest that agencies implement the new project specifications in stages, starting with a pilot-test of a small amount of the new product, and using the project on a trial basis to make sure it meets performance needs, before purchasing large amounts of the alternative products.

4 Developing and Implementing Green Purchasing Programs to Increase the Use of Environmentally Preferable Products

State DOTs have been taking small and large steps toward implementation of green purchasing in their agencies. DOT representatives shared the following approaches that had worked for their agencies and facilitated progress toward using less toxic alternatives and reducing their own materials and toxics management burdens.

- Since items for highway infrastructure, such as guardrail, picnic tables, traffic lighting, and other non-chemical products are often purchased via privatized construction or maintenance contracts, rather than purchased directly by the department, some DOTs have implemented contracts that now require that they purchase and install items with recycled content, such as plastic lumber picnic tables and similar items for rest areas. Greener specifications are sometimes incorporated in contracts for janitorial services and supplies used at rest areas as well.
- Mn/DOT publishes a pollution prevention report annually, which also states the product changes the DOT has implemented.
- To get the word out and advance the state of the practice, Mn/DOT has designated people statewide that meet twice annually. Part of this group's function is to find and test new green products, rate the products, and pass this information out to Mn/DOT statewide.
- The Mn/DOT environmental section works with the Office of Maintenance to advertise green products within Mn/DOT via a web site. The state is continually adding to this list: http://www.dot.state.mn.us/products/index.html
- Mississippi DOT outsources bridge painting and the environmental requirements associated with that activity. Mississippi also uses environmentally friendly grease spill products and cleaners for removing asphalt from dump trucks. All waste paint is recycled.
- Washington State DOT maintains a web-based list of herbicides, amounts used and costs at http://www.wsdot.wa.gov/Maintenance/Roadside/
- Oregon DOT uses self-contained washing systems for cleaning parts. Where practical, Oregon uses water based parts washers and manages the wastewater through a vehicle washwater filtration system. When solvent cleaning is necessary, Oregon DOT uses virgin cleaning solvents and recycles used solvent to prevent hazardous waste from getting into the waste stream. Recently, ODOT has been testing biodegradable Canola based lube products with the hope of replacing "WD-40" type products.
- Oregon DOT trains maintenance employees in ODOT's Environmental Management System (EMS), recycling automotive and shop waste wherever possible, disposing of

waste properly while maintaining Conditionally Exempt Generator status, using HVLP (High Volume Low Pressure) methods when performing (minimal) painting processes, filtering waste water from truck wash and parts cleaning areas, eliminating chlorinated cleaning products, and storing materials in accordance with a SPCC (Spill Prevention Control Countermeasure) plan. Oregon DOT's efforts have enabled them to acquire the Pollution Prevention Excellence certificate for Automotive Services.

- At North Dakota DOT, districts utilize a special procurement contract for purchasing green products.
- Massachusetts DOT is verifying that traffic line and markings paint is a water based, lead-free, chromium-free formulation (Ennis Traffic Paint Co. brand), or otherwise thermoplastic. Massachusetts DOT recently learned that some brands still use lead in both thermoplastic and waterborne or VOC traffic paint, a concern since markings last for approximately one season before eroding into the environment.
- The New York DOT Fleet Management operation deals with hundreds of products that are widely used in the automotive field and sold over the counter at most auto parts supply stores. Several years ago the Region 4 FA&S shop adopted a goal to lower the amount of hazardous waste generation in the region. They were able to reduce their hazardous waste generation from a "Medium Quantity Generator" to a "Conditionally Exempt Quantity Generator". This not only had a positive effect on the environment, but the DOT realized a substantial economic savings as well.
- In 2004, ALDOT received a consent order from the state environmental regulatory agency for their inability to handle and store hazardous waste. The consent order required ALDOT to eliminate and/or reduce many of the wastes generated in operations. In response, ALDOT:

    1. Evaluated and substituted biodegradable and/or non-toxic alternatives to more harmful products.
    2. Developed a Product Purchasing System to enable the DOT to monitor and control individual products and quantities ordered by its facilities.
    3. Participated in numerous recycling programs, which eliminated the need for waste disposal of such items as used oil, batteries, fluorescent light bulbs, and some herbicides.
    4. Initiated employee training on the proper management of hazardous and toxic materials.

4.1 Benefits of a Green Purchasing Program

There are many benefits to implementing a green purchasing program to increase the use of environmentally preferable products (EPP). First and foremost, green purchasing reduces the amount of toxic chemicals in the environment. By definition, green products contain fewer toxic chemicals that may be harmful to people, animals, and the environment. As an example, an evaluation of the benefits of using products that meet Green Seal's GS-37 standard for

industrial and institutional cleaners, when compared with conventional cleaners, documented that the products that met the Green Seal standards used 69% less energy and 66% fewer resources in their manufacture than conventional cleaners. Comparing Green Seal-certified cleaning products to conventional cleaning products, the conventional cleaners had a significantly higher environmental impact in all the categories analyzed: respiratory inorganics, acidification/eutrophication, fossil fuels, eco-toxicity, carcinogens, land use, and climate change.

Decreasing the use of toxic substances in cleaning and maintenance products positively impacts local air and water quality and serves to protect worker's health. In addition, purchasing green products can reduce energy and water consumption (in product generation, use, and clean up), which both benefits the environment and can generate agency cost savings. Finally, some green products reduce the amount of waste that is generated, another source of cost-savings as well as an environmental benefit. For example, Mn/DOT is very proactive with regard to finding less toxic alternatives; at one time the agency spent about $250,000 annually on hazardous waste disposal in its maintenance operations, but today Mn/DOT spends only about $20,000, according to interviews conducted for this project. Reducing solid waste also reduces disposal costs and helps protect land resources. Using less toxic products may also lead to decreased need for personal protective equipment, another source of cost savings.

The most dramatic cost savings for state DOTs implementing environmentally preferable purchasing will most likely come from products and activities that reduce energy and water use, and that lead to decreased volumes of hazardous and solid waste.

The most dramatic cost savings for state DOTs implementing environmentally preferable purchasing will most likely come from products and activities that reduce energy and water use, and that lead to decreased volumes of hazardous and solid waste. Reducing the use of toxic chemicals will lead to improvements in air and water quality.

4.2 Implementing a Green Purchasing Program

The first step for any state agency seeking to implement a comprehensive green purchasing program is to gather information about current purchasing practices and policies. Specifically, each state DOT should pull together information on:

- Current procurement data by product categories (annual dollar volume by category, current product standards or specifications and whether the current specifications call for EPP, and the end date of current contracts, as well as the schedule of upcoming bidding opportunities for each contract).
- Current procurement policies, procedures, organization, and staffing relating to materials usage, particularly for toxics.

For a fully functional green purchasing program to be implemented, this type of information needs to be routinely captured in some kind of readily accessible data system.

The second step is for the state agency to develop a detailed Green Purchasing Action Plan. First year goals are to put the Green Purchasing Action Plan in place, set specific goals for the amount of each product that should meet the new "green" specifications, clarify responsibilities and provide training and/or orientation for the new expectations, and to design feedback systems for how these goals will be tracked. Each year thereafter, the number of products included in the Green Action Plan, and the requirement for the percentage of each product category that should meet the new specs can be increased. Feedback informs understanding of the obstacles and issues the organization is encountering and how these may be best addressed.

For some product categories, there is a higher level of confidence that suitable alternatives can be found to meet the specification outlined. In these instances, we recommend that 100% of the products purchased meet the EPP specification. In other cases, a phased approach is more appropriate. In these cases, it makes sense to phase in the EPP specification by recommending that only a portion of the products purchased need to meet the specification (i.e. 20%), and that this portion be increased incrementally as suitable products are identified that meet the performance and cost requirements of the state DOT.

This plan will be based on information collected as part of step 1, above, and should include:

- Effective policies, procedures, organization, and staffing to implement the Green Action Purchasing Plan or steps to establish these elements as needed.
- Prioritization of product categories by dollar volume, environmental significance, improvement potential (or steps to develop this prioritization as needed).
- Implementation schedule for green purchasing based on prioritization, timing of upcoming bidding opportunities, and ease of implementation for each category (or steps to develop this implementation schedule as needed).
- Environmentally preferable product specifications to be used in purchasing for current year of implementation schedule (or steps to develop EPP specifications as needed).
- Monitoring and reporting protocols to document progress on green purchasing.

Once the Green Action Purchasing Plan is in place, it is critical that the agency monitor progress with the plan quarterly and that they conduct an annual review of the Green Action Purchasing Plan to allow management to review progress, identify any obstacles to increased green purchasing that need to be addressed, and make adjustments to the plan as needed. Each annual review should also involve updating the plan to identify specific products/contracts to update the following year to require environmentally preferable products.

In addition to the identification of specific products where the specification for future bids will be revised to require environmentally preferable products, it is also important for each agency to educate purchasing staff, and the staff that use the products, about why green purchasing is important, and to adopt agency-wide policies that clearly state the organization's commitment to green purchasing. A robust green purchasing program would include the following:

- An explicit statement of commitment to green procurement from top management.

- An explicit policy statement on green procurement explaining broad goals for the institution.
- Evidence that green procurement has been incorporated in standard and routine procurement procedures such as in relevant manuals or documents or in purchasing procedures and instructions to purchasing agents, as well as evaluation methods that address adherence to procedures and expectations.
- Evidence that the agency has explicitly engaged its workers (including purchase request originators as well as administrative procurement staff) in the greening process through education, and rewards and incentives.
- Evidence of communication and education about green procurement throughout the organization.
- Explicit designation of authority and responsibility for green procurement.
- Provision of rewards or staff incentives for adherence to green procurement, policies, and procedures and for innovative or superlative performance in achieving green procurement goals.
- The institution's successful implementation of environmentally preferable purchasing for at least 50% of its priority product categories, representing at least 50% of total spending in the priority categories (these percentages should increase over time).
- The agency routinely monitoring its performance by conducting an internal audit at least once or twice a year, including periodic collection and tracking of data on performance in green procurement, evaluation against explicit performance targets, and review by top management for improvement or realignment.
- The institution implementing its schedule for continued improvement in shifting the bulk of its purchases to environmentally preferable products and services over time.

Green purchasing programs are environmental management systems of sorts and follow many of the same steps, from initial setting of policies and goals, reviewing and revising policies and procedures, training, tracking, feedback, and program review and revision for the following year. Environmental management systems are designed as planning, implementation, monitoring, and feedback systems for continual learning and improvement. With any environmental management challenge, more systematic approaches yield more consistent results and more comprehensive change. Online guidance for developing an EMS is available at: http://environment.transportation.org/environmental_issues/environ_mgmt_sys/ and Developing and Implementing an Environmental Management System in a State DOT, AASHTO EMS Practitioner's Handbook #8.

The Green Purchasing Manual produced as part of this project is intended to be a catalyst to help state DOTs implement their own EPP program. The manual includes a number of introductory sections that provide an overview on how the EPP product specifications are structured, different purchasing strategies to implement green product specifications, and how to track the percentage of products purchased that meet the green specifications. The manual

also includes specifications for 19 products that were identified as part of the research for this project.